**MATHEMATICS, 2010**

# Level 1

Schedules

## 90147 Use straightforward algebraic methods and solve equations

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**Assessment Schedule: 90147 Algebra**

|  | Part | Evidence | Standard level | Judgment | Overall Grade for question |
| --- | --- | --- | --- | --- | --- |
| Q1 Algebraic Methods | 1a i  ii  iii | 3x2 + 13x – 10  (x + 11)(x – 6)  9p – 3 | 2 out of 3  Ach | Equivalent answers accepted.  CAO for Ach on any part  Replacement for Q1a can be taken from Q1c i, Q1c ii  Replacement for Q1b can be taken from Q1c iii, Q1d ii, Q1e (if working shown).    .  Mis-interpreting the answer of 12.59 m/sec as being “too slow” should not preclude an ‘Ach’ grade.  Rounding of moat width should br UP always e.g.. not 15.7 but 15.8 | Any 2 Ach = A  Any 4 out of 6 from 1a and 1b = A  2 Ach plus 1 Merit = M  OR 2 Merit = M  M plus Exc = E |
| 1b i  ii  iii | 4y8  4m4  3  5p2 + 4m - 6p | 2 out of 3  Ach |
| 1c i  ii  iii | (x + 5)(x – 5)  x – 3  8a  15 | 2 out of 3  Merit |
| 1d i  ii | 21.43 km  h = (7D÷25)2 | Both correct  Merit |
| 1e i  ii | Substituting =5 and w=10 gives V = 12.59m/s.  This is slower than 14 m/s so Yes, tiger could escape.  Rearranged eqn is  w = √((V2÷9.8-h)2-h2)  and required width is  15.748 metres | Ach for 1e i  Merit for e ii  Exc for both correct. |
| Q2 Solving Equations | 2a i  ii  iii | x = 7 or 0.4 (both needed)  m = 13.5  x = 2.25 | 2 out of 3 = Ach | Equivalent answers accepted.  CAO for Ach on any part.  Either(or both) of 2b can be used as replacement for one (or 2) of Q2a.  Q2d can be used as replacement for one of Q2a | Ach = A  Ach plus 1 Merit or 2 Merit = M  M plus Exc = E |
| 2b i  ii | y = -16/11  x = 4 or -13 (both needed) | Merit if both solved. |
| 2c | c = 3n2 + n  2 2 | Merit |
| 2d | s = $1.95  c = $2.60 | Merit |
| 2e | Possible solution method has x, y, z be the 3 dimensions of cuboid such that  xy = 61.74 so y = 61.74/x  xz = 50.96 so z = 50.96/x  yz = 32.76  so substituting as above and solving for x gives x = 9.8. It then follows that y = 6.3 and z = 5.2. Thus volume = 321.048 cm3 | Excellence. | Forming one equation AND rearranging it correctly can be used as Merit. |

Overall grade:

**Achievement 2 x A, or A & M**

**Merit 2 x M or A & E**

**Excellence 1 x M & 1 x E or 2 x E**

Achieving the Standard requires **both** the use of algebraic methods **and** solving equations. The 2 questions address these more-or-less separately. However a holistic approach is recommended. For example, Q2c might be used for evidence of methods needed in Q1; or the Merit/Excellence skills shown in Q2 **might** be considered evidence for Merit in Q1 if needed. However, markers should always keep in mind the word ‘**both**’.

\*If candidate answers both 1e and 2e, but doesn’t otherwise show requirements for A or M, then E can be awarded anyway.

**Assessment Schedule: 90148 Graphs**

|  | Part | Evidence | Standard Level | Judgment | Overall Grade for Question |
| --- | --- | --- | --- | --- | --- |
| **Question One** | 1a i | Straight line. Gradient ¾ and y intercept at -2 | Achievement sketch AS | Parabolas should be symmetrical and should not curve back on themselves.  Replacement for MI or MQ can be found from 1c ii. | 2 x AS = A  Replacement evidence can be found from 1b i or 1 b ii or even 2b i;  A plus 2 M (either MS or MI or MQ) = M\*  M plus Excellence |
| 1a ii | Parabola, x-intercepts -2 & 3,  y-intercept -6, T.P. (0.5, -6.25) | Achievement sketch AS |
| 1b i | Parabola, x-intercepts 1 & 5,  y-intercept 5 and T.P. at (3,-4) | Merit sketch MS |
| 1b ii | Parabola, x-intercepts 0 & 8,  y-intercept 0, T.P. at (4,8) | Merit sketch MS |
| 1c i | y = 52 | Merit Interpret MI & also Merit Equation MQ |
|  | 1c ii | Translated equation is  h=-2(w-16)(w-26)  = -2w2 + 84w -832 so a = -2,  b = 84 and c = -832 | Excellence.  Can also be MI or MQ (or AI) if needed. | Accept x and y instead of w and h |
| **Question Two** | 2a i  ii  iii | 2 km or 2000 metres  approx 23 mins  1 km per 10 mins or 6 km/hr | Achievement Interpret AI  Achievement Interpret AI  Achievement Interpret AI | Accept 21-24 mins but not 25.  Accept y & x instead of d & t.  Accept any answer suggesting understanding that lines should stop. | 2 x AI = A  A + 3 M (either MS or MI or MQ) = M\*  \*An **overall** merit grade requires at least 1 example of **each** of MS, MI and MQ  and at least l extra example of one of those skills (i.e. at least 4 Ms in the paper).  M + E = E |
| 2a iv  v  vi | d = 2000  d = 3500 – 100t  When they meet they stop and swim. Hence lines BC and DE should stop at this point, replaced by a horizontal line | Merit Equation MQ  Merit Equation MQ  Merit Interpret MI |
| 2c i  ii  iii | Straight line through (0, 10) and (4, 0).  No cattle, 1000 sheep.  X can only be in the range 0 to 4. Otherwise one of the animals would have a negative total. | Merit Sketch MS (or AS)  Merit Interpret MI (or AI)  Merit Interpret MI (or AI) |
| 2d | Variety of equations possible depending on position of x and y axes. If x axis is at level of release, and y axis is through max height then equation is  y = -0.05x2 + 3.2  and put falls to height of -2 (ground level) at x = 10.198 metres so a total length of 18.198 metres. | Correct equation must be shown.  Both parts needed for Excellence.  Equation only = Merit MI or MQ (or AI) |

**For Achievement** 2 x A

**For Merit**  1 x A plus 1 x M or 2 x M but **must** be at least 1 **each** of MS, MI, and MQ and **1 more** M in the whole paper.

**For Excellence** 1 x M plus 1 x E or 2 x E

A holistic approach to marking is recommended. Achievement requires **both** sketching **and** interpreting of suitable graphs, AS and AI (at least one example of each with **more than one example for one skill**). Merit requires **all three** of sketching, interpreting and writing equations, MS, MI and MQ (at least one example of each with **more than one example for at least one of those skills**). It may be possible a student meets those criteria but still misses out on an appropriate grade when the schedule is followed strictly. Also, should a candidate correctly answer **both** Excellence questions, but otherwise fail to achieve Merit (or Achievement), they can still be awarded Excellence but only if they have somewhere correctly sketched at least one graph (the Excellence questions don’t include the sketching skill).

**Assessment Schedule: 90194 Probability**

|  | Part | Evidence | Standard Level | Judgment | Overall Grade for Question |
| --- | --- | --- | --- | --- | --- |
| Question one | 1a i  ii  iii | 24/64 or 3/8  24/179  18/57 | 2 out of 3  Ach | Allow equiv fractions, decimals or % for all relevant parts of both questions. | Ach = A  A plus Merit = M  M plus Excellence = E |
| 1b i  ii  iii | 0.7 x 0.05 = 0.035  0.035 + 0.009 = 0.044  35/44 | 2 out of 3 Merit (any can be replacement for Ach) |
| 1c | Prob true positive = 0.007 x 0.91 = 0.00637  Prob false positive = 0.993 x 0.06 = 0.05958  So Prob a given positive is a true positive = 637/5958 = 10.69% | Replacement Merit (or Ach) for calculating either ‘positive’ probability.  Excellence for final result. |
| Question two | 2a | 1/40 | Ach | Accept rounding to 7 or 8 for 2d if evidence of good working or theory. | Any 2 Ach = A  A plus one Merit = M  M plus Excellence = E |
| 2b | 9/40 | Ach |
| 2c | 6/40 x 5/39 = 1/52 | Merit or Ach |
| 2d | Prob (5 in a set of 6 draws) = 6/40 or 3/20.  Expectation = 3/20 of 52 = 7.8 times. | Ach for correct probability.  Merit |
| 2e | Prob of (1st number but not 2nd ) = 6/40 x 34/39 =17/130  Prob of ( 2nd number but not 1st) = 34/40 x 6/39 = 17/130  So Prob of (exactly 1 out of 1st 2) = 34/130 = 17/65  Thus must have bought 520 lines (17/65 x 520 = 136).  Prob (both numbers) = 1/52 (Q2c) which = expectation of exactly 10 lines having both of 1st 2 numbers. | Merit (or Ach) for either of:  Prob(1st only)  Prob(2nd only).  No credit for Prob(both numbers) as it’s repeat of Q2c.  Excellence for all correct.  Allow consistency with Q2c. | In event of **correct** calculation of Prob(both) **here**, after incorrect answer to Q2c, then credit can be given here. |

Overall grade:

**Achievement 2 x A,**

**Merit 2 x M, or 1 x M (or E) plus 1 x A**

**Excellence 2 x E\*, or 1 x M plus 1 x E**

A holistic approach to marking is encouraged. For example calculations in 2d or e **might** provide evidence to replace errors in Q1a, or 1b. Note however that for Merit, a candidate **must** **as an absolute minimum** have shown the ability to **both** calculate probabilities of a combination of events **and** interpret information in context.

\*If candidate answers both 1c and 2e, but doesn’t otherwise show requirements for A or M, then E can be awarded anyway.

**Assessment Schedule: 90151 Number**

|  | Part | Evidence | Standard Level | Judgment | Overall Grade for Question |
| --- | --- | --- | --- | --- | --- |
| Question One | 1a | 8 | Achievement | CAO is sufficient for Achievement  Some evidence of method needed for Merit.  Excellence must include clear methods. Allow one small error in calculating one cost, **or** for overlooking **one** of insurance, licence, or bus saving. Reasonable approximations e.g. petrol to $1000 (or even to $2 per litre), allowed, or even encouraged. | 1 Ach = A1  2 Ach = A2  Either A1 or A2 plus 1 Merit = M  M plus Exc = E |
| 1b | ¼ or equivalent fraction | Achievement |
| 1c | 195.7 ÷ 0.858 = $228.09 | Merit or Achievement |
| 1d | 81 ÷ 500 x 6 = 0.972 mm so 9.72 x 10-1 mm | Merit for complete correct answer.  Ach for 0.972 mm |
| 1e | Service = 300 x 2 x 1.125 = 675 p.a.  Insurance = 23 x 12 = 276 p.a..  Petrol is 160 ÷ 12 x 1.90 x 52 = 1317 p.a. or ¾ of this after flatmate’s contribution = $987.75  Total = 675+276+987.75+250 (licence) = 2189 less( 7 x 52 bus saving)s = 1825 p.a. ÷ 8320 km =22 cents/ km. | Achieved for any of  -service  -petrol  calculated correctly in a relevant correct manner (eg p.a. or per km).  Merit for both of above.  Excellence for correct answer. |
| Question Two | 2a | $533.50 | Achievement | CAO is sufficient for Achievement  Some evidence of method needed for Merit.  Excellence must include clear methods | 1 Ach = A1  2 Ach = A2  Either A1 or A2 plus 1 Merit = M  M plus Exc = E |
| 2b | $90 $90 and $135 | Achievement |
| 2c | Protozoa = 2500  After chemical, copepods fall to 200 so new protozoa figure = 1700 i.e. drop of 800 out of 2500 = 32% or -32% | Achieved for stating **new** figure for either copepod or protozoa.  Merit for final %. Accept either positive or negative %. |
| 2d | 0.0165% of 4.0 x 1014 = 6.6 x 1010 m3 of plankton.  x 1100 kg = 7.26 x 1013 kg  31/80 is Phytoplankton = 2.813 x 1013 kg | Merit (or Ach) to here.  Excellence |

Accept appropriate premature rounding. Money answers should be rounded to 2 d.p. or less. Accept rounding to nearest 10 cents.

Overall grade for Standard.

**Achievement** 2 x A at least one of which must be A2

**Merit** 2 x M or 1 x A and 1 x E (including at least one A2)

**Excellence** 1 x M plus 1 x E\*

A holistic approach to marking is recommended. A candidate showing some ability to solve straightforward number problems, in context, involving a **selection** from fractions, decimals, percentages and ratios, should qualify for at least Achievement even if the ‘spread’ of the evidence through the paper doesn’t actually match the strict requirements of this schedule.

\*Candidates correctly answering **both** Q1d **and** Q2d can be awarded E even if they haven’t otherwise fulfilled criteria for A or M

**Assessment Schedule: 90152 Right Triangles**

| Question One | Part | Evidence | Standard Level | Judgment | Overall Grade for Question |
| --- | --- | --- | --- | --- | --- |
| 1a | Any correct rounding of 7.90253 m | Achievement Pythagoras | See note at end of schedule.  If an incorrect earlier answer is used to solve a problem, allow consistency if appropriate.  Some problems can be solved in more than one way and may have slightly different, but still correct answers.  Rounding should be appropriate for Merit and Excellence. | 2 Ach = A but note below under ‘Overall Grade for Standard”  A + 1 Merit = M  M + Exc = E |
| 1b | Any correct rounding of 38.32011° | Achievement  Trig |
| 1c | Any correct rounding of 1.92029 m | Achievement Pythagoras |
| 1d | 6.52 m | Merit trig |
| 1e | 1.244 m + 1.3 m = 2.544 m | Merit either |
| 1f | Possible method uses line perpendicular to AC meeting B forming 2 right triangles. Call new line BD.  Angle A = 288-252 = 36° so length of BD = Sin36 x 18.3 = 10.756m and length AD = Cos36 x 18.3 = 14.805 m.  Angle BCD is 41°  Length CD = 10.756 ÷ tan41 = 12.373 so AC = 12.373 + 14.805 = 27.16 m | Finding any correct length can be used as replacement for Merit (or Ach). Depending on method used it is possible to use both trig and Pythagoras.  Final answer = Excellence. |
| Question Two | 2a | Any correct rounding of 13.109° | Achievement Trig | 2 Ach = A  A + 1 Merit or 2 Merit = M  M + Exc = E |
| 2b | Any correct rounding of 74.95331 m | Achievement Pythagoras or Merit Trig (finding hypotenuse with trig is Merit) |
| 2c | Any correct rounding of 16.27841 m | Achievement Trig |
| 2d | 98.13 m | Merit Trig |
| 2e | 52.4° | Merit Trig |
| 2f | √(7.22 – 5.12) = 5.08232 m  5.08232 ÷ Sin58 = 5.99 m | Can be used as replacement for Merit (or Ach)  Excellence |

Notes:

In **all** questions there must be evidence that Pythagoras and/or trigonometry has been used. This may take the form of mnemonics (e.g. Sohcahtoa), correct trig expressions or ratios, or appropriate working. CAO is **never** sufficient.

Rounding errors are not a reason to deny credits. However be sure that any error is a rounding error (or premature rounding) rather than a miscalculation. Inappropriate rounding can be a reason to reduce higher grades to A. Use professional judgment. A reasonably high standard should be set for Excellence including rounding skills. Units are not needed for A and M. They are implied in all questions.

It is suggested that if it appears a calculator has been set on Rad or Grad, that the first such error be marked wrong but others be marked ‘for consistency’ i.e. candidate gets appropriate grade if the calculator setting is the only error made. However if professional judgement suggests candidate should have spotted a resultant answer as being wildly wrong, they don’t get any credit for the answer.

Overall grade for Standard.

To be awarded credits, a candidate must use BOTH Pythagoras AND trigonometry correctly..

**Achievement** 2 x A or 1 x A plus 1 x M

**Merit** 2 x M or 1 x A plus 1 x E

**Excellence** 1 x M plus 1 x E\*

\*Candidates correctly answering **both** Q1d **and** Q2d can be awarded E even if they haven’t otherwise fulfilled criteria for A or M

**Assessment Schedule: 90153 Geometry**

|  | Part | Evidence | Standard Level | Judgment | Overall Grade for Question |
| --- | --- | --- | --- | --- | --- |
| Question One | 1a | ∠ GFE = 63° base ∠ isos Δ  ∠ GFH = 117° ∠ on line = 180° | Achievement for all of 1a, 1b, 1c, if CAO but Merit for each if correct reasoning shown. | Other correct chains of reasoning are acceptable. | Two Achievement for A  At least One Achievement and one Merit or 2 Merit for M  M + Excellence = E |
| 1b | ∠FAD = 30° 90° - 60° ∠ equilateral Δ  ∠ADE = 150° Co-int ∠ |
| 1c | ∠FAB = 72° Ext angle regular pentagon.  ∠ABF = 72° Base angle Isos Δ  ∠AFB = 36° ∠ in Δ |
| 1d | a + b + c = 360° Ext. angles of polygon.  a+x = 180° Angle on line.  b+y = 180° Angle on line  c+z = 180° Angle on line  a+x+b+y+c+z = 540°  so x+y+z = 540° - (a+b+c) = 540° - 360° = 180°  So Int angles of triangle always = 180° | Excellence if correct reasoning used to prove angles in triangle = 180°  Replacement for Merit (or Ach) available if 2 different statements made. Repeating “Angle on line” not needed if it’s stated once. |
| Question Two | 2a | Any correct rounding of 3593.333 km | Achievement for all of 2a, 2b, 2c, if CAO but Merit for each if correct reasoning shown. | Other correct chains of reasoning are acceptable. | Two Achievement for A  At least One Achievement and one Merit or 2 Merit for M  M + Excellence = E |
| 2b | x + y = 90° ∠ in Δ  z = 90° ∠ on line |
| 2c | ∠ACB = 22° Alt angle  ∠AOB = 44° Angle at cntr twice angle on circumference.  ∠ADO = 114° Angle in Δ  ∠BDC = 114° Vert opp angles. |
| 2d | DF = diameter because ∠DEF = 90°  B = Center of circle and BC = radius because BD=BF  ∠ACB = 90° radius perp to tangent.  ∠ABC = 52° Angles in triangle.  ∠CBF = 128° Angles on line. | Important that justification is given to say BC is a radius. Cannot just assume ∠ACB = 90°  Excellence |

Overall grade for Standard:

**Achievement 2 x A or 1 x A plus 1 x M**

**Merit 2 x M or 1 x A plus 1 x E**

**Excellence 1 M plus 1 E or 2 x E**

A holistic approach is encouraged. Merit can only be awarded when clear correct reasons are shown – otherwise grade is Achievement. It is recommended (but technically not mandatory) that a Merit grade should include evidence of Angle Geometry in circles (which is not a requirement for Achievement).

\*If candidate answers both 2c and 3c, but doesn’t otherwise show requirements for A or M, then E can be awarded anyway.